PROJECT PROPOSAL FOR RESIDENT RESEARCH TO BACKSTOP THE WEST AND CENTRAL AFRICAN MAIZE AND COWPEA RESEARCH NETWORKS

JOINTLY SUBMITTED TO
USAID BURKINA FASO
BY

THE INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

AND

THE COORDINATION OFFICE OF THE SEMI-ARID FOOD GRAIN RESEARCH AND DEVELOPMENT (SAFGRAD)

S U M M A R Y

This proposal requests the United States Agency for International Development (USAID) to fund the resident research component intended to backstop the West and Central African Maize and Cowpea Research Networks to the amount of $4,332,700 for a period of three (3) years.

Resident Research will be conducted in Burkina Faso for the development of new varieties and production techniques that will be tested by the research networks.

Introduction

Africa is afflicted with continuing food crisis which has assumed alarming propositions in recent times. In the Semi-Arid Zones which constitute the Semi-Arid Food Grain Research and Development (SAFGRAD) project mandate area, food production has consistently failed to keep pace with the rate of population growth. Furthermore, the traditional food production systems are grossly inadequate to satisfy the food needs of the increasing rural and urban populations.

Food production in African Semi-Arid Tropics (SAT), is largely in the hands of peasant small-holders whose traditional farming methods are yet to be adapted to utilize improved techniques of cultivation and purchased inputs. It is estimated that the 26 countries in the region together have close to 230 million farmers. The overall crop yields from their farms are far below potential levels nad have remained unchanged or even declined during the last two decades.

The environment of semi-arid Africa is characterized by high temperatures, low, highly variable and unpredictable rainfall patterns, fragile and mostly infertile soils. The area is subjected to serious continuous degradation as a result of the recent series of droughts enhanced by a rapid desertification process. Rainfall and its distribution are also major critical factors in food production in the region. Average total annual precipitation ranges from 300 mm in the driest areas to 1000 mm in other areas. Throughout the semi-arid tropics, there are wide seasonal fluctuations and great variations in the intensity of rains and interval between rainy periods. In areas with a reasonably high rainfall regime, over-population leads to heavy cultivation and over exploitation which also causes rapid degradation of the fragile resource base.

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Rapid progress to substantially increase the food production capacity of Semi-arid African countries can be made by improvement in local production systems, developed by scientific research and effectively communicated through national agricultural extension services to the farmers.

The SAFGRAD Project (JP 31) was launched in 1977 as a collaborative venture between OAU/STRC and USAID, with the aim of improving production of staple food grains of the region viz, sorghum, millet, maize and cowpea. Since 1978, IITA/SAFGRAD was assigned the responsibility for conducting regionally oriented research in collaboration with national, regional and international research agencies/centres to develop improved varieties of maize and cowpea as well as cultural practices compatible with farming practices of African semi-arid tropics, and to promote their adoption and use in farmer's fields. The major objectives of the IITA/SAFGRAD project have been:

a) To assist and strengthen national maize and cowpea programs in the African Semi-Arid Tropics.

b) To develop improved varieties and agronomic management practices capable of giving higher and more stable economic yields in semi-arid environments.

c) To organize and promote systematic regional testing of available genetic materials and technologies in the semi-arid tropics.

d) To assist in the training and manpower development of African nationals at all levels.

e) To promote the interaction and cooperation between national scientists of SAFGRAD member-countries and to break the barriers of scientific communication between these countries.

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To achieve these objectives, IITA/SAFGRAD, effective from 1979, undertook two types of research activities: Resident research and Regional trials. Resident research, conducted in Burkina Faso in two ecologies for maize and three for cowpeas, consisted of development of new production technologies which were later tested along with those from the national agricultural research systems (NARS) in regional trials - a collaborative research undertaking involving SAFGRAD, IITA and the NARS. Donor evaluation of the SAFGRAD Project concluded that implementation of IITA component during the project's first phase had produced many positive results consistent with, and contributing to achievement of project goals, and recommended extension of the project to a second phase of 5 years. The emphasis during the next phase is to develop the capacity of national program scientists to enable them to assume increasing responsibility in the cowpea and maize collaborative research networks in West and Central Africa. Resident research undertaken during phase one of the SAFGRAD Project will be continued during phase two to provide backstopping to these networks.

To implement these recommendations, the Directors of National Agricultural Research Systems of 26 SAFGRAD member-countries met on February 23 to 27 1987, reviewed progress made in SAFGRAD I, charted the course of SAFGRAD II, and agreed on the establishment of research networks on cowpea, maize, sorghum and millet. They further recommended the continuation of resident research to backstop these networks within the framework of SAFGRAD II. In pursuance of this objective the SAFGRAD Coordinating Office and IITA/SAFGRAD organized a workshop for scientists working on maize and cowpea in 18 countries of West and Central African (March 23 - 27, 1987), to inventory production constraints for these crops. They also elected steering committees which would

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determine the scope of work of these collaborative research networks, identify capacities and weakness of different national programs, prioritize network activities and allocate research responsibilities among various national programs.

2. Achievements of IITA/SAFGRAD Project

The Semi-Arid Food Grain Research and Development Project was designed to effectively mobilize and coordinate research resources including those of International Agricultural Research Centres and the National Agricultural Research Systems in order to provide the technological base necessary to achieve significant advances in food grain production. Some of the notable achievements of IITA/SAFGRAD collaborative research include:

2.1 Through regional testing activities provided several elite materials of maize and cowpea that are being used by NARS in their crop improvement program (18 - 22 member-countries of SAFGRAD). These varieties possessed significant stress resistant traits to drought, pests and diseases. In case of maize, early and intermediate regional uniform trials (RUVT) were carried out. From 1979 to 1985, over 192 sets of early maturing (RUVT-1) and 171 sets of intermediate maturing trials (RUVT-2) were made available to national programs of SAFGRAD countries. A total of 44 varieties have been tested in RUVT-1 and 42 varieties in RUVT-2. National programs have also contributed their best yielding varieties for a wider adoption trials, and development of early maturing drought resistant varieties of maize and cowpea. Two high yielding early maturing varieties of maize known as SAFITA-2 and SAFITA-104 have been widely tested

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by national programs. These have either been released or are in the process of pre-release in Burkina Faso, Ghana, Mali, Benin, etc... Another variety, SAFITA-102, is a medium maturing variety developed for the Northern Guinea savanna zone. It has been widely tested in many SAFGRAD countries. Major agronomic practices that minimize risk to drought stress were identified such as tied-ridges, soil tillage practices, use of early varieties and maize-cowpea rotation practices.

2.2 A number of cowpea varieties have been widely tested by the national programs. A multiple disease resistant and high yielding cowpea variety KN-1, was released in moderate (700mm) rainfall zone. SUVITA-2, a drought and striga tolerant cowpea variety was developed and widely tested. It is included in the pre-extension trials in many SAFGRAD member countries. Another variety, 58-57 has also been shown to have a high level of resistance to striga. Considerable progress has been made in defining and recommending practices for the maize cowpea cropping system in the Northern Guinea savanna zone. Some progress was made for sorghum and millet/cowpea inter-cropping systems also.

2.3 The development of soil fertility/water retention technologies. It has been demonstrated that tied ridges can conserve water. To alleviate labour constraints two versions of mechanical device adapted to annual traction (donkey and oxen model) were developed. In 1985 alone more than 130 prototype units of these tied-ridgers were widely distributed to farmers and research cooperators. Due to lack of funding large number of these units were not made in order to evaluate these mechanical tied-ridgers in different SAFGRAD member countries.

2.4 Several varieties of maize and cowpea were released by participating countries through technical back-stopping of IITA/SAFGRAD program.

2.5 National programs in many SAT countries are weak in manpower resources and this weakness impeded NARS from taking advantage of available improved technologies. The IITA/SAFGRAD program based in Burkina Faso has provided in-service training for 31 researchers, crop production oriented courses for over 50 participants, supervision of thesis work for 18 participants. Long-term training (M.Sc. Ph.D. levels) for 28 participants from various countries on different aspects of food grain research and production.

2.6 Workshops: Since 1979, seven workshops were held on maize and cowpea improvement involving 400 scientists from different SAFGRAD member countries. This has facilitated the exchange of technical information among scientists.

3. The Project

3.1 Overall Objectives

The objectives of this project are:

i) To provide technical backstopping to maize and cowpea activities (18 - 22 countries) through development of suitable technology (cultivars, agronomic practices and integrated pest management systems) adaptable to the variable and unpredictable agricultural environment of the semi-arid tropics.

ii) To fully effect the transfer of breeding materials and research methodology to NARS accrued during the last eight years of resident research of the IITA/SAFGRAD team.

iii) To facilitate accelerated transfer to relevant research results to farmers by supporting the SAFGRAD on-farm testing activities

iv) To provide short and long-term training support to actively participating NARS in order to improve their respective research capabilities.

3.2 Specific Objectives

The scope of the project will be to conduct resident research that will backstop the maize and cowpea networks. The following are the areas where resident research will be focused:

3.2.1 Maize Breeding

a) Breeding for extra-early and early varieties

b) Breeding for drought resistance

c) Varietal maintenance

d) Breeding nurseries for training purposes

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3.2.2 Maize Agronomy

a) Evaluation of the medium and long-term effects of both traditional and improved management practices on soil physical and chemical properties.

b) Testing and development of cropping systems involving legumes which could lead to a reduction in the need for chemical nitrogen fertilizers.

c) Evaluation of cropping systems involving associations with maize and non-leguminous crops which would result in more efficient utilization of available resources, reduced risk, and/or better soil conservation practices.

d) Continue the evaluation of genotype x management interaction, with emphasis on aspects of soil fertility and drought stress.

e) Continue development and testing of implements used for making tied ridges with animal traction.

f) Refined recommendations developed to date for maize production in the SAT.

g) Establish the proper management practices for growing improved varieties in the SAT of West Africa.

h) Fertilizer-use efficiency studies.

i) Continue studies aimed at reducing the risk of drought stress and reducing soil compaction.

j) Continue collaboration with Maize Breeding Program for improving maize drought resistance.

k) Striga control studies.

3.2.3 Maize Entomology

a) In the long term, considerable emphasis should be placed on identifying sources of resistance to major arthropod pests, especially termites and stem borers.

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b) In the short term, less toxic and cheaper alternatives to Furadan for protection of maize from major field arthropod pests should be identified and evaluated.

c) Both traditional and improved maize grain storage systems should receive more detailed evaluation.

d) Determine the role of natural enemies in maize pest suppression.

3.2.4 Cowpea Breeding

As is evident from the results obtained, considerable progress has been made in different aspects of the cowpea breeding research. But still the work was not complete, and the important aspects of the work that need to be continued and strengthened are on Striga and drought resistance.

a) Striga Resistance

Work needs to be concentrated on identifying sources of resistance to striga strains existing in Niger and Nigeria, and confirming multiple strain resistance in the variety, B3011.

Once it is done, considerable efforts are needed to combine this resistance with other desirable traits such as drought, insect pests, diseases, good seed quality, high yield etc., for wider as well as specific adaptation.

Also the collaborative work with the Weed Research Division at Long Ashton need to be continued or may be strengthened to find out mechanism of resistance, genetic diversity of physiological strains, and on identifying and confirming new sources of resistance to Striga.

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b) Drought

The work on drought resistance needs to be combined in developing or identifying new drought tolerant dual purpose varieties specifically suitable for the cereal based cropping systems in the Sudan and Sahel Savannas of West Africa.

3.2.5 Cowpea Agronomy

An integrated crop management approach needs to be developed. It has the merit of assuring maximum crop productivity while conserving land base resources. To achieve this approach the following research activities need be conducted:

a) Identification of high-yielding; better-adapted; and drought, Striga disease and insect pest resistant cultivars.

b) Identification of hedgerow (shrubs or trees) crops compatible with crop plants. They will serve as wind break, provide mulch and protect land against rain and wind erosion.

c) Identification of appropriate cover crop plants and development of appropriate crop residue management, including zero-tillage, use of herbicides and fertilizers.

d) Identification of animal drafted or tractor pulled equipments for: mechanical sowing, pesticide spraying and fertilizer broadcasting etc.

3.2.6 Cowpea Entomology

a) Host-plant resistance to the major insect pests of cowpea in the field and storage: Aphids, flower thrips, Maruca pod borer, Hemipteran pod bug and bruchids.

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b) Judicious insecticide use - (minimum protection - 2 sprays) with emphasis on cost and safety.

c) Potential for Biological Control: use of predators, parasites and pathogens.

d) Increased exploitation of cultural crop management practices (cultural control) for pest population reduction.

3.2.7 Soil Water Management

Development of management systems which result in root extension and proliferation in the subsoil have been given a high priority in IITA/SAFGRAD's Soil-Water Management Program. It is felt that a long-term solution may be achieved only by appropriate manipulation of crop rotations and cropping systems. Mechanical manipulation of the soil with this objective in mind has met with little long-term success in the past.

a) Development of minimum tillage systems using residue mulch for sandy soil of the West African Semi-Arid Tropics. (WASAT).

b) Development of alley-cropping systems for WASAT.

c) Characterization of intercropping systems of the WASAT.

d) Development and utilization of tillage implements for the West African Semi-Arid Tropics, including animal traction implements.

3.2.8 Training

The project focus would also be to support training in deficient areas of maize and cowpea research and production.

Budget

Table 1, shows the three-year budget for the proposed resident research to backstop the Central and West African Cowpea and Maize Research Networks.

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Table 1: Budget for Resident Research to backstop the West and Central African Maize and Cowpea Research Networks.

Item	Yr. 1	Yr. 2	Yr. 3	Total
4. Salaries and Allowances	$	$	$	$
i) Professional Staff				
- Maize Breeder	96.1	80.5	98.4	275.0
- Maize Agronomist	96.1	80.5	98.4	275.0
- Cowpea Agron/Physiologist	96.1	80.5	98.4	275.0
- Cowpea Breeder	96.1	80.5	98.4	275.0
- Cowpea Entomologist	96.1	80.5	98.4	275.0
Sub-total (i)	480.5	402.5	492.0	1,375.0
ii) Local Support Staff[a]				
- Technical Support Staff	15.4	16.2	17.0	48.6
- General support staff	32.4	34.0	35.7	102.1
- Administrative support staff	44.9	47.1	49.5	141.5
Sub-total (ii)	92.7	97.3	102.2	292.2
iii) Household Furnishings including				
- Electricity, water and maintenance b]	144.5	123.0	123.0	390.5
iv) Cold storage facility	5.0	-	-	5.0
v) Irrigation facilities	25.0	-	-	25.0
vi) Chemical handling facility	10.0	-	-	10.0
vii) Working facilities	5.0	5.0	5.0	15.0
Sub-total (iii) to (vii)	189.5	128.0	128.0	445.5
viii) Operational Expenses				
Facility Maintenance including minor repairs	40.0	15.0	15.0	70.0
- Local Supplies and expenses	55.0	55.0	55.0	165.0
- Field and lab supplies	45.0	45.0	45.0	135.0
- Soil and plant analysis expenses	35.0	35.0	35.0	105.0
- Vehicle operations	50.0	50.0	50.0	150.0
- Labour for Research activities	110.0	110.0	110.0	330.0
- Travel (Local/International)	66.4	66.4	66.4	199.2
Sub-total (viii)	401.4	376.4	376.4	1,154.2

a] For details, see the detailed budget notes. NB. a 5% increase in salary per year has been used in the calculation.

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b] See detailed budget notes for particulars.

Budget cont'd.

		Yr. 1	Yr. 2	Yr. 3	Total
ix)	Commodities and Equipment				
	- Computer facility	20.0	-	-	20.0
	- Vehicles	148.5	-	-	148.5
	- Motor-cycle, Mobylettes and Bicycles	19.0	-	-	19.0
	- Tractor and accessories	59.5	-	-	59.5
	Sub-total (ix)	247.0			247.0
x)	Training				
	- In-residence costs	36.0	36.0	36.0	108.0
	- International travel	2.4	2.4	2.4	7.2
	- Thesis preparation	6.0	6.0	6.0	18.0
	Sub-total (x)	44.4	44.4	44.4	133.2
(xi)	Total of Subtotal (i) - (x)	$1,455.5	1,048.6	1,143.0	3,647.1
xii)	Overhead costs 18.8% of (xi)	$273.6	197.1	214.9	685.6
	Total costs (xi + xii)	$1,729.1	1,245.7	1,357.9	4,332.7

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5. Budget Notes

i) Personal Emoluments

Salaries and Allowances:	Figures (Thousands) 88/89	89/90	90/91	Total
	US $	US $	US $	US $
Professional Staff [a]				
- Salary/fees	40.0	42.0	44.1	126.3
Fringe Benefits:				
- Compassionate/Annual Leave	3.0	3.0	3.0	9.0
- Health/Ins./Med. Evaluation	5.0	5.0	5.0	15.0
- Superannuation/Retiring Benefits	6.4	7.0	7.8	21.2
- Initial/Terminal Travels	10.0	-	15.0	25.0
- Orientation/Language Courses	8.0	-	-	8.0
Allowances:				
- Cost of Living Allowance	10.0	10.0	10.0	30.0
- Child Education Allowance [b]	8.0	8.0	8.0	24.0
- Car Basic/Insurance Premium	3.0	3.0	3.0	9.0
- Hardship Allowance	2.5	2.5	2.5	7.5
- Representation Allowance	-	-	-	-
Total	96.1	80.5	98.4	275.0

a] The following professional staff are proposed for the project:

1 Maize Breeder
1 Maize Agronomist
1 Cowpea Breeder
1 Cowpea Agronomist/Physiologist
1 Cowpea Entomologist

Total for Year 1 for 5 scientists	$480.5
Total for Year 2 for 5 "	$402.5
Total for Year 3 for 5 scientists	$492.0

b] Assumes an average of two children per scientist.

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A. Local Support Staff

1. Technical:

a) Per Scientist

1 Technician (B.Sc/M.Sc Level) @	120.000 CFA/m	
2 Observators (BEP, BAC) @	95.000 "	
3 Permanent Labour @	85.000 "	
Total	300.000 "	+ 55,500 CFA (Social

security @ (18.5%) = 355,500 CFA/m

+ 355.500 CFA = $1185/m x 13* = $15,405

b) General

3 Mechanics:		
1 Chief mechanic @	100,000 CFA/m	
2 Assistants @	80,000 "	
2 Tractor drivers @	100,000 "	
5 Drivers @	300,000 "	
1 Storekeepter @	50,000 CFA/m	
Total	630,000 + 116,550 = 746,550 CFA	
	i.e. $2488.5/m x 13* = $32,350.5	

2. Administrative

1 Administrative Assistant @	150,000 CFA/m	i]
1 Accountant @	125,000 "	
1 Clerical Officer @	100,000 "	
1 Cashier @	75,000 "	
3 Secretaires @	300,000 "	
1 Secretaire de Direction @	125,000. "	
Total	875,000 + 161,875 = 1,036,875 CFA	
	i.e. $3,456.25 x 13* = $44,931.25	

B. Household Furnishings

1. Hard furnishings - $20,000/staff - $20,000/staff - $20,000

Replacement for current staff:

a) Washing machine (1No.)	@	$600***
b) Drier	" @	300
c) Refrigerators (2) @ $525 each		950
d) Freezer	(1) @	950
e) Cooker	(1) @	400
	Sub-total	3,200

* Termination benefits (about a and month's salary/yr.)

i] Assuming full time Administrator hired, otherwise a local Administrator at much higher salary will be needed: - $790/m (Social Security inclusive)x 13* = $10,270.

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B. Household Furnishings cont'd

2. Rent: $700/m per house x 12 months x 5 houses	$42,000
3. Electricity: $600/m per house x 12 months x 5 houses	$36,000
4. Water: $250/m per house x 12 months x 5 houses	$15,000
5. Telephone (fixed cost and local calls) @ $100/m per house x 12 months x 5 houses	$6,000
6. Security guards (2) @ $192 x 13m/house x 5 houses	$24,960
Subtotal	$123,960
7. House Maintenance:	
- Fixture repairs, etc - $500/house x 5 houses	$2,500
- Painting (every 2 years)	
- Materials - $900, Labour - $300 = 1,200 x 5 houses	$6,000
8. Lawn Mover (1)	$800**
9. Voltage stabilizers 6 per house @ $300 each x 5 houses	$9,000
Subtotal	$18,300

C. Cold Storage Facility

Keep present facility but with improvements

2 new air conditioners	$600 x 2	= $1,200***	
Sundry repairs		$3,800	= $5,000

D. Irrigation Facility (for dry season/drought work)

1 good sized durable pump/a good supply of pipes	$25,000

E. Chemical Handling Facility

2 strong exhuaust fans	@	$3,000 each.	
1 good sized hood (plexiglass)	-	$1,500	
storage facility	-	$2,500	= $10,000

F. Working Facilities (3 sites)

Land clearing and preparation at 3 locations (Saria, Gampela and Pobe) @ 45,000 CFA/year	$5,000

N.B. Include Estimates for soft furnishings, lamps, etc.

*** "Duty-free prices"

** Local price (with tax)

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G. Facility Maintenance including minor modifications

1. General (current facilities)	$10,000
2. Three (3) new offices (remodelling + furniture)	$15,000
3. Electricity at 15,000/year	$15,000
Sub-total	$40,000

H. Local Research Supplies and Expenses

a) Local Supplies and Expenses:

- Fertilizers, pesticides, pegs, tags - $55,000]
- Field and Lab. supplies + Field facilities, maintenance and operation - $45,000]

] See the attached list of research equipment required

b) Soil/Plant Analyses (Maize and Cowpea Agronomy) at 1000 samples/year. - $35,000

I. Commodities and Equipment

i) Computer facility: 2 PC Units + 1 Word Processor - $20,000

ii) Project Cars:

- 5 Land Cruisers Station Wagon @ $23,500 each - $117,500
- 1 Peugeot Pickup will be needed for Administrative work. Cost is estimated at — $11,000
- 1 Minibus for carrying students will be required. Cost of Minibus is estimated at — $20,000

Total cost of vehicles - $148,500

iii) Motor-cycles, Mobylets and Bicycles:

- 1 Motor-cycle will be required at a cost of - $3,000
- 10 bicycles will be required at $100 each - $1,000
- 25 mobylets will be required at $600 each - $15,000

Total cost of Motor-cycle, mobylets and bicycles $19,000

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iv) Farm Machinery - Prices based on 1986 Catalogs:

- 1 John Deer Tractor	$45,000
- 1 Disc Plough	3,000
- 1 Disc narrow	9,000
- 1 ridger	2,500
Total	$59,500

J. Training

It is envisaged that a maximum of 12 trainees per year will be in-residence for a period of 6 months at a cost of $500 per month per student: = 12 x 500 x 6 = $36,000.

- At lease six students will come outside of Burkina Faso and will require an airticket at an average cost of $400 per student: = 400 x 6 = $2,400.

- Thesis preparation is estimated to cost $500 per student, therefore thesis preparation for 12 students will be 500 x 12 = $6,000

Total Training costs per year = $36,000 + 2,400 + 6,000 = $44,400

6. RESEARCH EQUIPMENT NEEDED FOR THE PROJECT

6.1 Maize Breeding:

a) Field Scales (4)
b) Measuring Tapes (4)
c) Moisture tester Dikkey Johns (4)
d) Shoots bags (20,000)
e) Pollination bages (30,000)

6.2 Maize Agronomy:

a) Ovens for soil/plant samples (2)
b) Double ring infiltraters (4)
c) PF rings:(120)
d) Soil thermometers (40)
e) Root augers (2)
f) Aluminum Moisture tires (500)
g) Assorted laboratory supplies (beakers, graduated cylinders spatulas, filter paper).
h) Electronic balance (2kg), (1)
i) Electronic balance (4kg), (1)
j) Plant mill large (1)
k) Plant mill small (1)
l) Leaf area meter (1)
m) Milk balances (3)
n) Soil sampling equipment

6.3 Soil and Water Management:

a) Neutron Probe + Accessories
b) Diffusion porometers
c) Augers
d) Infiltrometers
e) Soil Thermometers

6.4 Cowpea Agronomy:

a) Infrared thermometer (2)
b) Thermometer (air) (30)
c) Soil thermometers - 5cm (30)
d) Soil thermometers - 10cm (30)
e) Soil thermometers - 20ck (30)
f) Leaf paromoter and accessory (2)
g) Leaf area meter (1)

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h) Microscope (1)

i) Anemometers (12)

j) Tensiometer - 15cm (8)

k) Tensiometer - 15cm (8)

l) Tensiometer - 30cm (8)

m) Tensiometer 45^2cm (8)

n) Tensiometer - 30cm (8)

o) Soil Augers (6)

p) Aluminum boxes - 5cm diameter (400)

q) Seed planters under zero-tillage with in situ mulch:

- hand propelled (4)
- animal drafted (4)
- tractor pulled (4)

r) Sprayers:

- animal drafted (4)
- tractor pulled (4)

6.5 Entomology:

Height traps

Replacement fl. Bull

Killing Jars

Ethyle Acetate

Sweep Nets

Insect mounting equipment

Relaxing Boxes + Relaxant (chlorocresol)

Suction Aspirators

Hygro - thermographs (+ Ink + sheets)

Maxi - Minimum Thermometers

Vials

Cork Boreres

Rubber Laboratory Aprons

Hot plates

Insect collection equipment

Dissecting Sets

D. Vac samplers

1987

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IITA

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